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ABSTRACT

Data on the sources, amounts, and trends of federal funding for engineering research and development (R&D) are presented for 1980-1984. Narrative highlights are provided for: the total federal funding obligations for engineering R&D, mechanical engineering, astronautical engineering, aeronautical engineering, chemical engineering, civil engineering, electrical engineering, and metallurgy and materials. Tables provide data on federal funding obligations broken down by selected agencies and engineering disciplines for each of the 5 years and for 3 categories of funding: total research, basic research, and applied research. Federal funding obligations to colleges and universities for total research, basic research, and applied research are tabulated in a similar manner. The following federal agencies are covered: Department of Agriculture, Department of Commerce, Department of Defense, Department of Energy, Department of Interior, Environmental Protection Agency, National Aeronautics and Space Administration, and National Science Foundation. Combined totals for all other agencies for each selected discipline are also supplied. (SW)

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FEDERAL FUNDING

OF

ENGINEERING RESEARCH AND DEVELOPMENT

1980 - 1984

Prepared by:
Federal Government Relations Department
Council on Public Affairs
American Society of Mechanical Engineers
April 1984

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INTRODUCTION

Much has been said and written about Federal Government funding for research and development. Many engineers have expressed interest and concern about federal R&D funding for engineering, but information on the subject is not always at hand. Therefore, this report is an attempt to provide the engineering community with information that we hope will be useful for analyzing the sources, amounts and trends of federal funding for engineering R&D. The report is aimed at providing straight-forward factual information, and does not attempt to analyze the data in great detail or relate it to public policy alternatives.

The source for the data is the National Science Foundation, which collects information on the R&D budgets of all federal agencies. While one can question how lines were drawn between, for example, mechanical and aeronautical engineering, or how engineering is separated from science, the information is that which the agencies themselves compiled and regard as asociated with a particular engineering discipline.

This is our first attempt to compile and publish this information. We plan to issue an update when the 1985 budget information can be compiled. We invite reader comments and suggestions.

Federal Government Relations Department
Council on Public Affairs
American Society of Mechanical Engineers
Washington, D.C.

DATA HIGHLIGHTS
(1980 - 1984)

Total Federal Funding Obligations for Engineering R&D

* Federal Government funding for all R&D grew 52 percent from $29.8 billion to $45.3 billion between 1980 and 1984. During the same period, the engineering part of that funding grew just 25 percent, from $2.8 billion to nearly $3.5 billion. The engineering part of total federal R&D funding declined from 9 percent to 8 percent.

* Among the engineering disciplines separated for the report, aeronautical had the largest dollar support throughout the five years, and reached $797 million in 1984. However, metallurgy and materials showed the largest percentage (52) increase, and electrical had the largest dollar ($167 million) increase over the period. Mechanical engineering was the only discipline to show a decline for total federal funding, while chemical tended to be the most erratic--with alternate year increases and decreases.

* Basic research for engineering grew 69 percent, from $465 million to $786 million. All engineering disciplines singled out in the data enjoyed increases; metallurgy & materials consistently showed the largest dollar support, reaching $198 million in 1984. Civil engineering was consistently the low recipient, and totals $37 million in 1984.

* Funding for applied engineering research increased over 14 percent, from $2.36 billion to $2.70 billion. However, the 1984 total of $2.7 billion was down from 1982 and 1983 totals; electrical and metallurgy & materials enjoyed most of the increase; mechanical and chemical experienced declines, with the most significant suffered by mechanical.

* Among specific agencies, the Department of Defense (DOD) funded $1.62 billion or 46 percent of all federal engineering research in 1984; the figures for 1980 were $1.16 billion and 41 percent. The Department of Energy (DOE) showed the largest percentage increase of all agencies during the period--60 percent, followed closely by the National Science Foundation with a 57 percent boost. The National Aeronautics and Space Administration (NASA) also had an increase in total funding for engineering research, while the Environmental Protection Agency (EPA), Department of Commerce (DOC), and Department of Interior (DOI) all reported decreases.

* With the exception of DOC, all agencies showed an increase for funding of basic engineering research, with the largest dollar increases coming at DOD and NASA.

* For applied engineering research, the major increases came at DOD and DOE; DOC, DOI, EPA and NASA had decreases.

* Total federal R&D funding for universities and colleges grew 38 percent, from $324 million to $447 million; the percentage going to universities and colleges was 11 percent in 1980 and 13 percent in 1984. Electrical was the largest recipient of total research dollars, with $108 million in 1984; electrical and metallurgy & materials combined received $203 million, or 45 percent of the total going to universities and colleges.

* Federal support for basic engineering research at universities and colleges grew 60 percent, from $208 million to $334 million; all engineering disciplines showed increases.

* Federal support for applied engineering research at universities and colleges showed a decline from $115 million to $113 million; mechanical, civil, electrical and metallurgy & materials showed small increases, while aeronautical, astronautical and chemical had decreases.

* DOD and NSF steadily supplied the bulk of total funding for universities and colleges, followed by NASA and DOE.

DATA HIGHLIGHTS
(1980-1984)

Mechanical Engineering

* Only engineering discipline in report to experience a decline in total federal funding during the period; funding slipped from $208 million in 1980 to $203 million in 1984.

* DOD supplied 70 percent of the total R&D support in 1984, up from 59 percent in 1980.

* Total funding also grew during the period at DOC, NASA, NSF and the Department of Agriculture (DOA); however of these agencies, only NSF provided more than $6 million in 1984.

* Total funding fell at DOE, from $26 million to $10 million; at DOI, from over $6 million to $205,000, and at EPA, from $12 million to $3 million.

* Basic research funding increased over the 5 year period 52 percent, from $42 million to $64 million. All agencies in the report showed increases in basic research except DOI. The largest dollar increases came at DOD and NSF.

* Suffered the largest decrease in applied research of all engineering disciplines in report; applied research fell from $166 million to $138 million; chemical engineering was the only other discipline to experience a decline.

* DOD was the source of 78 percent of the applied research in 1984, up from 60 percent in 1980; DOE funding plummeted from $23 million to $4 million over the period; EPA funding tumbled from nearly $12 million to less than $3 million; and DOI support fell from over $6 million to $205,000.

* Total funding for R&D at universities and colleges increased 48 percent, from $33 million to $49 million; funding increased across all agencies except DOI and DOA. In 1984, DOD provided $21 million or 43 percent of the total, while NSF was the source for $19 million or 39 percent.

* Basic research at universities and colleges increased 54 percent, from $26 million to $40 million; basic research accounted for over 81 percent of all federal funding at universities and colleges in 1984; NSF was the largest source with $18 million in 1984, followed by DOD.

* Applied research at universities and colleges increased from $7.3 million to $8.6 million; DOD and NASA provided 86 percent of the total in 1984.

DATA HIGHLIGHTS
(1980 - 1984)

Astronautical Engineering

* Total federal funding increased 18 percent over the five year period, from $302 million to $357 million; DOD and NASA supply over 99 percent of the total.

* Basic research jumped 222 percent, from $27 million to $60 million, with the increase evenly distributed between DOD and NASA.

* Applied research grew a modest 8 percent from $275 million to $297 million. In 1984, NASA supplied $220 million, or 74 percent of the total.

* In 1984, universities and colleges will receive just $16 million or less than 5 percent of the total federal funding; DOD will supply $14 million; nevertheless, the $16 million total was more than double the 1980 figure of $7 million.

* Basic research at universities and colleges grew from $1 million to $10 million.

* Applied research for universities and colleges has remained fairly constant around the $6 million level.

DATA HIGHLIGHTS
(1980 - 1984)

Aeronautical Engineering

* Single largest engineering discipline recipient of total R&D funds throughout the period.

* Of the 1984 total of $798 million, NASA ($535 million) and DOD ($259 million) supplied over 99 percent of the total.

* Second largest engineering discipline recipient of basic research dollars; grew 82 percent during the period, from $104 million to $189 million.

* Consistently led all engineering disciplines in applied research; however, funding remained virtually at the same level during the 5 year period.

* Only 5 percent, or $43 million of aeronautical engineering R&D funds are going to universities and colleges in 1984; $27 million will come from DOD and most of the remainder from NASA; The $43 million total was up 13 percent from the 1980 figure of $38 million.

* $29 million of the $43 million for universities and colleges is for basic research, with the remainder for applied.

DATA HIGHLIGHTS
(1980 - 1984)

Chemical Engineering

* Smallest recipient of the seven engineering disciplines identified in the report; in 1984, received $108 million, or 3 percent of total support for engineering R&D.

* Funding was erratic, with a high of $148 million in 1981 and low of $95 million in 1982.

* Largest single source is DOD, which supplied $43 million in 1984 or 40 percent of total R&D funding; other significant sources are NSF, DOE, EPA, DOA and DOI.

* Basic research grew 54 percent, from $26 million to $40 million. In 1984, NSF provided $22 million, or 55 percent of the total; DOD followed with $12 million and DOA with $3 million.

* Applied research declined from $70 million to $68 million, with a high of $116 million in 1981 and low of $60 million in 1982. In 1984, DOD was the major source with $30 million, followed by DOE ($18 million) and EPA ($9 million); Hoever, EPA support was down from a high of $56 million in 1981.

* Universities and colleges received a total of $26 million in 1984, up about 30 percent from 1980. NSF provided the bulk of the funding with $22 million in 1984.

* In 1984, of the funds going to universities and colleges, 23 million, or 88 percent, is for basic research.

DATA HIGHLIGHTS
(1980 - 1984)

Civil Engineering

* The second lowest recipient of total federal funding; support grew 10 percent over the five year period, from $159 million to $175 million.

* In 1984, DOD was largest source with $46 million, followed by NSF ($36 million), DOE ($30 million) and EPA ($12 million).

* Major declines in funding come at DOI, DOC, and EPA.

* Has consistently been the smallest recipient of basic research funds; however, such funding grew 68 percent during the period, from $22 million to $37 million; of the $37 million in 1984, $29 million came from NSF.

* Applied research totaled $138 million in 1984, about the same as 1980, but down from $170 million in 1982. DOD is the largest source of applied research in 1984 with $41 million, followed by DOE with $30 million; in 1984 it is the top engineering recipient of applied research funding from NSF, EPA, and DOE.

* R&D funding at universities and colleges increased 50 percent, from $22 million to $33 million. Of the 1984 total of $33 million, $29 million comes from NSF and most of the remainder from DOD.

* In 1984, $27 million, or 82 percent of total funding for universities and colleges is for basic research.

DATA HIGHLIGHTS
(1980 - 1984)

Electrical Engineering

* In 1984 is the second largest engineering recipient with total funding of $684 million.

* Of all engineering disciplines, enjoyed the largest dollar increase in funding between 1980 and 1984, with an increase of $167 million.

* In 1984, DOD supplied 84 percent, or $575 million of the total. Other significant sources were NSF ($40 million), Energy ($25 million) and NASA ($24 million).

* In 1982, passed civil engineering as the leading recipient of NSF funding.

* Since 1981, has been the largest recipient of engineering funding from DOC, and was leading recipient throughout the 5 year period from DOD. It has generally been the smallest recipient from EPA, and received only minor support from DOA and DOI.

* Basic research increased 62 percent, from $71 million to $115 million; DOD ($73 million in 1984) and NSF ($35 million in 1984) supply most of the funding.

* Applied research grew 27 percent, from $447 million to $568 million; DOD provided $502 million, or 88 percent of the total in 1984; DOE was a distant second with $24 million.

* Funding at universities and colleges grew 40 percent, from $77 million to $108 million; electrical has consistently been the leading engineering recipient at universities and colleges. The $108 million in 1984 is 24 percent of the $447 million total for all engineering funding at universities and colleges; this percentage was steady throughout the five year period.

* DOD ($67 million in 1984) and NSF ($36 million) provide the bulk of the funding for universities and colleges.

* In 1984, $76 million, or 70 percent of total electrical engineering funding for universities and colleges is for basic research; the $76 million ranks second to metallurgy & materials.

* Of the engineering disciplines, receives the largest amount of funding for applied research at universities and colleges by a wide margin. The 1984 total of $33 million is 29 percent of the $113 million total for all engineering; DOD supplied $26 million of the $33 million.

DATA HIGHLIGHTS
(1908 - 1984)

Metallurgy and Materials

* Third largest engineering recipient with $360 million in 1984.

* Had the largest percentage increase in funding during the period, growing 53 percent, from $236 million to $360 million.

* DOD is the largest source, with $196 million in 1984.

* Consistently the largest recipient from DOE, reaching a high of $68 million in 1984.

* Consistently the largest recipient from DOI, but the 1984 total of $31 million is down from the 1980 high of $45 million.

* Other significant sources in 1984 are NSF ($33 million), NASA ($21 million) and DOC ($8 million).

* Consistently the largest recipient of basic research funding, which grew from $121 million in 1980 to $198 million in 1984; the 1984 total represents 25 percent of all federal funding for basic engineering research.

* DOD ($97 million), DOE ($50 million) amd NSF ($30 million) are the largest sources of basic research funding in 1984; DOE's $50 million represents 70 percent of that agency's funding for basic engineering research.

* Applied research grew 71 percent, from $115 million to $161 million. In 1984, DOD will supply $99 million, or 61 percent of the total. Other important sources are DOI ($18 million), DOE ($17 million) and NASA ($14 million).

* Consistently second to electrical as the largest engineering discipline funded at universities and colleges. University funding grew 67 percent, from $57 million to $95 million; largest sources in 1984 were DOD ($45 million), NSF ($29 million) and DOE ($14 million).

* Consistently the largest engineering discipline funded at universities and colleges for basic research, reaching $87 million in 1984; the $87 million constitutes 26 percent of the $333 million for all engineering.

* Applied research at universities and colleges was $7 million in 1984, exceeding funding for astronautical, chemical and civil engineering.

FEDERAL FUNDING OBLIGATIONS FOR TOTAL RESEARCH
By Selected Agencies and Engineering Disciplines

Total All Agencies
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	207,978	204,646	201,228	198,784	202,729
Aeronautical	708,134	709,577	741,158	756,879	797,630
Astronautical	302,325	303,936	290,734	339,997	357,488
Chemical	96,335	147,624	95,118	138,875	107,875
Civil	158,781	159,112	201,919	193,514	175,002
Electrical	517,142	556,674	612,186	617,637	683,713
Metallurgy & Materials	236,184	255,972	309,129	336,393	359,655
Engineering, NEC[1]	603,252	733,913	935,071	919,410	802,806
Totals	2,830,131	3,071,454	3,386,543	3,501,489	3,486,898

Department of Agriculture
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	3,762	3,906	4,274	4,184	4,080
Chemical	4,457	5,278	5,794	5,966	5,971
Civil	4,318	4,694	3,904	3,960	3,873
Electrical	329	242	313	345	351
Engineering, NEC[1]	33,761	36,589	36,891	39,420	38,711
Totals	46,627	50,709	51,176	53,875	52,986

1: Not Elsewhere Classified
2: Estimates

Source: National Science Foundation

FEDERAL FUNDING OBLIGATIONS FOR TOTAL RESEARCH
By Selected Agencies and Engineering Disciplines

Department of Commerce
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	1,589	2,096	1,761	2,704	2,256
Aeronautical	85	-0-	-0-	-0-	-0-
Chemical	720	1,023	1,971	1,093	1,333
Civil	14,084	3,620	5,333	7,472	1,384
Electrical	13,112	10,950	10,006	10,411	9,375
Metallurgy & Materials	5,338	5,759	7,083	8,631	7,641
Engineering, NEC[1]	5,644	5,024	5,859	7,179	6,985
Totals	40,572	28,502	32,013	37,490	28,974

Department of Defense
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	122,378	136,560	144,000	134,087	141,620
Aeronautical	214,221	232,560	252,632	251,086	258,783
Astronautical	67,813	69,216	79,504	91,951	92,070
Chemical	24,049	31,089	39,029	42,679	42,653
Civil	30,149	34,909	40,439	41,651	45,761
Electrical	442,299	477,428	493,177	507,933	575,080
Metallurgy & Materials	104,171	131,600	159,276	170,353	195,561
Engineering, NEC[1]	160,146	210,767	265,217	241,345	266,531
Totals	1,165,266	1,324,129	1,473,274	1,481,085	1,618,059

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR TOTAL RESEARCH
By Selected Agencies and Engineering Disciplines

Department of Energy
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	25,589	16,981	7,387	15,114	10,348
Astronautical	-0-	-0-	2,539	-0-	-0-
Chemica	14,412	30,633	1,061	50,128	17,920
Civil	1,030	20,696	43,770	40,876	29,660
Electrical	14,760	13,737	45,095	31,439	24,799
Metallurgy & Materials	48,940	52,044	61,166	63,114	67,860
Engineering, NEC[1]	88,389	136,108	259,758	276,338	158,915
Totals	193,120	270,199	420,776	477,009	309,502

Department of Interior
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	6,681	5,146	1,716	1,193	205
Chemical	4,236	3,445	1,412	1,120	3,657
Civil	20,625	20,599	11,778	11,351	5,168
Electrical	961	5,324	1,017	868	1,092
Metallurgy & Materials	45,038	31,405	32,759	41,814	30,530
Engineering NEC[1]	1,599	2,586	38,453	41,999	23,423
Totals	79,140	68,505	87,135	98,345	64,075

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR TOTAL RESEARCH
By Selected Agencies and Engineering Disciplines

Environmental Protection Agency
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	11,780	-0-	6,596	4,091	2,752
Chemical	31,966	55,788	25,952	16,526	10,587
Civil	37,081	21,441	34,634	21,474	11,757
Electrical	4,426	-0-	2,786	934	528
Metallurgy & Materials	-0-	-0-	5,212	3,117	1,903
Engineering, NEC[1]	-0-	-0-	1,248	773	268
Totals	85,253	77,229	76,428	46,915	27,795

National Aeronautics & Space Administration
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	3,062	4,034	5,183	5,400	5,400
Aeronautical	491,398	475,787	486,944	503,360	534,691
Astronautical	233,793	233,863	207,842	246,947	263,519
Chemical	206	265	393	400	400
Civil	55	112	320	300	300
Electrical	4,103	4,256	20,100	21,985	23,684
Metallurgy & Materials	8,856	9,734	16,240	20,379	21,442
Engineering NEC[1]	58,155	52,657	34,681	20,554	20,646
Totals	799,628	780,708	771,703	819,325	870,082

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR TOTAL RESEARCH
By Selected Agencies and Engineering Disciplines

National Science Foundation
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	13,743	14,276	15,966	17,346	20,969
Aeronautical	1,048	-0-	497	543	661
Astronautical	-0-	153	184	194	245
Chemical	15,014	19,148	18,791	20,510	24,852
Civil	27,381	28,143	28,620	30,678	36,325
Electrical	21,692	27,986	30,347	33,011	39,631
Metallurgy & Materials	22,617	24,216	26,353	27,285	33,347
Engineering, NEC[1]	5,301	7,102	9,109	9,916	11,597
Totals	106,796	121,024	129,867	139,483	167,627

All Other Agencies
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	19,394	21,647	14,345	14,665	15,099
Aeronautical	1,382	1,230	1,085	1,890	3,495
Astronautical	719	704	665	905	1,654
Chemical	1,275	955	715	453	502
Civil	24,058	24,898	33,121	35,752	40,774
Electrical	15,460	16,751	9,345	10,711	9,173
Metallurgy & Materials	1,224	1,184	1,040	1,700	1,371
Engineering, NEC[1]	207,078	234,289	242,486	236,294	229,112
Totals	270,590	301,658	302,802	302 370	301,180

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR BASIC RESEARCH
By Selected Agencies and Engineering Disciplines

All Agencies
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	42,227	47,378	53,120	57,789	64,362
Aeronautical	104,157	113,284	126,465	137,666	188,765
Astronautical	27,184	33,179	44,845	51,979	59,674
Chemical	26,148	31,330	35,184	35,393	39,583
Civil	21,963	23,362	31,977	31,289	37,185
Electrical	70,586	78,508	93,625	91,891	115,382
Metallurgy & Materials	121,337	138,480	155,888	179,984	198,391
Engineering, NEC[1]	51,626	60,497	69,363	79,464	82,699
Totals	465,228	526,018	610,467	665,455	785,041

Department of Agriculture
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	1,125	1,157	1,483	1,495	1,542
Chemical	1,395	2,441	2,948	3,067	3,210
Civil	1,261	1,087	1,003	1,059	1,119
Electrical	158	61	136	153	166
Engineering, NEC[1]	10,526	11,802	12,668	13,760	14,310
Totals	14,465	16,548	18,238	19,534	20,347

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR BASIC RESEARCH
By Selected Agencies and Engineering Disciplines

Department of Commerce
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	102	366	477	529	553
Chemical	-0-	-0-	91	-0-	-0-
Civil	2000	-0-	-0-	-0-	-0-
Metallurgy & Materials	752	1,180	1,131	1,124	1,175
Engineering, NEC[1]	38	283	72	192	96
Totals	2,892	1,829	1,771	1,845	1,824

Department of Defense
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	23,738	27,288	29,258	31,229	33,143
Aeronautical	27,519	28,459	34,228	35,293	42,163
Astronautical	-0-	807	4,282	12,088	16,305
Chemical	9,510	9,282	10,927	11,540	12,378
Civil	1,546	2,664	3,177	3,435	4,581
Electrical	46,663	50,885	60,977	56,601	72,955
Metallurgy & Materials	57,346	65,883	79,464	91,951	96,766
Engineering, NEC[1]	3,415	2,878	5,863	2,945	3,096
Totals	169,737	188,146	228,236	245,082	281,387

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR BASIC RESEARCH
By Selected Agencies and Engineering Disciplines

Department of Energy
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	2,158	3,400	3,901	5,350	6,350
Chemical	211	2,183	-0-	-0-	-0-
Electrical	377	-0-	500	540	540
Metallurgy & Materials	34,816	39,309	40,604	45,380	50,320
Engineering, NEC[1]	5,005	8,969	8,719	11,215	13,343
Totals	42,567	53,861	53,724	62,485	70,553

Department of Interior
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	300	500	160	60	-0-
Chemical	287	-0-	120	100	-0-
Civil	596	1,365	602	470	550
Electrical	401	973	58	50	85
Metallurgy & Materials	4,229	4,150	4,894	9,881	12,415
Engineering, NEC[1]	1,079	500	6,328	12,377	10,286
Totals	6,892	7,488	12,162	22,938	23,336

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR BASIC RESEARCH
By Selected Agencies and Engineering Disciplines

Environmental Protection Agency
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	-0-	-0-	292	216	150
Chemical	-0-	-0-	4,366	2,473	1,519
Civil	-0-	-0-	5,035	2,408	1,378
Electrical	-0-	-0-	141	1	1
Metallurgy & Materials	-0-	-0-	260	119	47
Engineering, NEC[1]	-0-	-0-	226	139	158
Totals	-0-	-0-	10,302	5,356	3,253

National Aeronautics & Space Administration
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	1,448	1,794	2,496	2,550	2,550
Aeronautical	75,590	84,825	91,736	101,891	146,001
Astronautical	27,184	32,249	40,380	39,697	43,124
Chemical	173	253	348	350	350
Civil	55	112	320	300	300
Electrical	1,900	2,281	5,464	5,846	6,350
Metallurgy & Materials	5,080	5,255	5,853	7,117	7,620
Engineering, NEC[1]	1,864	1,913	2,283	2,300	2,300
Totals	113,294	128,682	148,880	160,051	208,595

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR BASIC RESEARCH
By Selected Agencies and Engineering Disciplines

National Science Foundation
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	13,356	12,123	14,553	15,860	19,474
Aeronautical	1,048	-0-	441	482	601
Astronautical	-0-	123	183	194	245
Chemical	14,572	17,171	16,584	17,863	22,126
Civil	16,505	18,134	21,840	23,617	29,257
Electrical	21,087	24,208	26,349	28,700	35,185
Metallurgy & Materials	19,114	22,603	23,482	23,912	29,748
Engineering, NEC[1]	3,690	5,879	8,076	8,825	10,557
Totals	89,372	100,241	111,308	119,463	147,193

Total All Other Agencies
(Thousands of Dollars)

	1980	1981	1982	1983	1984
Mechanical	-0-	750	500	500	600
Electrical	-0-	100	-0-	-0-	100
Metallurgy & Materials	-0-	100	200	500	300
Engineering, NEC[1]	-0-	-0-	300	100	200
Totals	-0-	950	1,000	1,100	1,200

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR APPLIED RESEARCH
By Selected Agencies and Engineering Disciplines

Total All Agencies
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	165,751	157,268	148,108	140,995	138,367
Aeronautical	603,977	596,293	614,693	619,213	608,865
Astronautical	275,141	270,757	245,889	288,018	297,814
Chemical	70,187	116,293	59,934	103,482	68,292
Civil	136,818	135,750	169,942	162,225	137,817
Electrical	446,556	478,166	518,561	525,746	568,331
Metallurgy & Materials	114,847	117,492	153,241	156,409	161,264
Engineering, NEC[1]	551,626	673,416	865,708	839,946	720,107
Totals	2,364,903	2,545,436	2,776,076	2,836,034	2,700,857

Department of Agriculture
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	2,637	2,749	2,791	2,689	2,538
Chemical	3,062	2,837	2,846	2,899	2,761
Civil	3,057	3,607	2,901	2,901	2,754
Electrical	171	181	177	192	185
Engineering, NEC[1]	23,235	24,787	24,223	25,660	24,401
Totals	32,162	34,161	32,938	34,341	32,639

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR APPLIED RESEARCH
By Selected Agencies and Engineering Disciplines

Department of Commerce
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	1,487	1,730	1,284	2,175	1,703
Aeronautical	85	-0-	-0-	-0-	-0-
Chemical	720	1,023	1,880	1,093	1,333
Civil	12,084	3,620	5,333	7,472	1,384
Electrical	13,112	10,950	10,006	10,411	9,375
Metallurgy & Materials	4,586	4,609	5,952	7,507	6,466
Engineering, NEC[1]	5,606	4,741	5,787	6,987	6,889
Totals	37,680	26,673	30,242	35,645	27,150

Department of Defense
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	98,640	109,272	114,742	102,858	108,477
Aeronautical	186,702	204,101	218,344	215,793	216,620
Astronautical	67,813	68,409	75,222	79,863	75,765
Chemical	14,539	21,807	28,102	31,139	30,275
Civil	28,603	32,245	37,262	38,216	41,180
Electrical	395,636	426,543	432,200	451,332	502,125
Metallurgy & Materials	46,825	65,717	79,812	78,402	98,795
Engineering, NEC[1]	156,731	207,885	259,354	238,400	263,435
Totals	995,489	1,135,983	1,245,038	1,236,003	1,336,672

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR APPLIED RESEARCH
By Selected Agencies and Engineering Disciplines

Department of Energy
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	23,431	13,581	3,486	9,764	3,998
Astronautical	-0-	-0-	2,539	-0-	-0-
Chemical	14,201	28,450	1,061	50,128	17,920
Civil	1,030	20,696	43,770	40,876	29,660
Electrical	14,383	13,737	44,595	30,899	24,259
Metallurgy & Materials	14,124	12,735	20,562	17,734	17,540
Engineering, NEC[1]	83,384	127,139	251,039	265,123	145,572
Totals	150,553	216,338	367,052	414,524	238,949

Department of Interior
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	6,381	4,646	1,556	1,133	205
Chemical	3,949	3,445	1,292	1,020	3,657
Civil	20,029	19,234	11,176	10,881	4,618
Electrical	560	4,351	959	818	1,007
Metallurgy & Materials	40,809	27,255	27,865	31,933	18,115
Engineering, NEC[1]	520	2,086	32,125	29,622	13,137
Totals	72,248	61,017	74,973	75,407	40,739

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS FOR APPLIED RESEARCH
By Selected Agencies and Engineering Disciplines

Environmental Protection Agency
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	11,780	-0-	6,304	3,875	2,602
Chemical	31,966	55,788	21,586	14,053	9,068
Civil	37,081	21,441	29,599	19,066	10,379
Electrical	4,426	-0-	2,645	933	527
Metallurgy & Materials	-0-	-0-	4,952	2,998	1,856
Engineering, NEC[1]	-0-	-0-	1,022	634	110
Totals	85,253	77,229	66,108	41,559	24,542

National Aeronautics & Space Administration
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	1,614	2,240	2,687	2,850	2,850
Aeronautical	415,808	390,962	395,208	401,469	388,690
Astronautical	206,609	201,614	167,462	207,250	220,395
Chemical	33	12	45	50	50
Electrical	2,203	1,975	14,636	16,139	17,334
Metallurgy & Materials	3,776	4,479	10,387	13,262	13,822
Engineering, NEC[1]	56,291	50,744	32,398	18,254	18,346
Totals	686,334	652,026	622,823	659,274	661,487

FEDERAL FUNDING OBLIGATIONS FOR APPLIED RESEARCH
By Selected Agencies and Engineering Disciplines

National Science Foundation
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	387	2,153	1,413	1,486	1,495
Aeronautical	-0-	-0-	56	61	60
Astronautical	-0-	30	1	-0-	-0-
Chemical	442	1,977	2,407	2,647	2,726
Civil	10,876	10,009	6,780	7,061	7,068
Electrical	605	3,778	3,998	4,311	4,446
Metallurgy & Materials	3,503	1,613	2,871	3,373	3,599
Engineering, NEC[1]	1,611	1,223	1,033	1,081	1,040
Totals	17,424	20,783	18,559	20,020	20,434

All Other Departments and Agencies
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	19,394	20,897	13,845	14,165	14,499
Aeronautical	1,382	1,230	1,085	1,890	3,495
Astronautical	719	704	665	905	1,654
Chemical	1,275	955	715	453	502
Civil	24,058	24,898	33,121	35,752	40,774
Electrical	15,460	16,651	9,345	10,711	9,073
Metallurgy & Materials	1,224	1,084	840	1,200	1,071
Engineering, NEC[1]	207,078	234,289	242,186	236,194	228,912
Totals	270,590	300,708	301,802	301,270	299,980

FEDERAL FUNDING OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR TOTAL RESEARCH
By Selected Agencies and Engineering Disciplines

Total, All Agencies
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	32,955	36,331	40,486	42,905	48,776
Aeronautical	37,758	39,277	38,495	39,341	43,016
Astronautical	7,317	8,752	9,582	15,849	16,252
Chemical	20,250	21,896	19,419	21,497	25,852
Civil	21,624	24,910	27,138	28,433	33,477
Electrical	77,266	86,087	88,611	88,597	108,375
Metallurgy & Materials	57,327	69,505	75,342	80,596	94,572
Engineering, NEC[1]	69,266	78,588	62,435	72,050	76,401
Totals	323,723	365,346	361,508	389,268	446,721

Department of Agriculture
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	227	87	84	91	94
Chemical	52	241	237	258	265
Civil	-0-	184	154	167	171
Electrical	-0-	21	25	27	27
Engineering, NEC[1]	7,099	7,861	8,562	9,282	8,768
Totals	7,378	8,394	9,062	9,825	9,325

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR TOTAL RESEARCH
By Selected Agencies and Engineering Disciplines

Department of Defense
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	15,034	17,476	18,699	19,336	21,114
Aeronautical	23,525	24,427	22,777	23,092	26,700
Astronautical	6,082	6,702	7,508	13,276	13,636
Chemical	3,821	3,188	1,934	2,043	2,167
Civil	1,338	2,915	2,749	3,387	3,870
Electrical	51,443	55,428	55,433	53,008	66,587
Metallurgy & Materials	22,168	29,200	34,036	36,563	44,603
Engineering, NEC[1]	626	1,973	3,195	3,372	4,922
Totals	124,037	141,309	146,331	154,077	183,599

Department of Energy
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	2,086	2,837	2,314	2,486	3,141
Astronautical	-0-	792	234	668	671
Chemical	2,770	1,504	173	476	478
Civil	43	529	1,548	681	370
Electrical	1,744	2,578	1,559	1,476	1,333
Metallurgy & Materials	9,642	13,080	11,910	13,882	14,157
Engineering, NEC[1]	25,144	25,661	10,145	15,051	15,895
Totals	41,429	46,981	27,883	34,720	36,045

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR TOTAL RESEARCH
By Selected Agencies and Engineering Disciplines

National Aeronautics & Space Administration
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	3,062	4,034	5,183	5,400	5,400
Aeronautical	13,187	14,850	15,419	15,925	15,925
Astronautical	1,235	1,122	1,670	1,725	1,725
Chemical	206	265	393	400	400
Civil	55	112	320	300	300
Electrical	4,103	4,256	4,426	4,600	4,600
Metallurgy & Materials	5,561	5,723	6,320	6,400	6,400
Engineering, NEC[1]	4,103	4,238	4,783	4,950	4,950
Totals	31,512	34,600	38,514	39,700	39,700

National Science Foundation
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	12,546	11,897	14,206	15,592	19,027
Aeronautical	1,046	-0-	299	324	391
Astronautical	-0-	136	170	180	220
Chemical	13,401	16,698	16,682	18,323	22,542
Civil	20,188	21,170	22,367	23,898	28,766
Electrical	19,976	23,535	27,168	29,486	35,828
Metallurgy & Materials	19,956	21,502	23,076	23,751	29,412
Engineering, NEC[1]	4,178	5,896	7,422	8,020	9,556
Totals	91,291	100,834	11,390	119,571	145,742

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR BASIC RESEARCH
By Selected Agencies and Engineering Disciplines

Total, All Agencies
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	25,659	28,639	32,106	33,831	40,171
Aeronautical	22,071	22,596	25,203	25,747	28,954
Astronautical	995	945	3,532	7,405	10,079
Chemical	16,946	19,807	16,802	18,582	22,841
Civil	15,068	17,441	18,966	21,260	26,669
Electrical	47,482	52,922	61,064	59,856	75,793
Metallurgy & Materials	51,871	62,583	69,648	74,320	87,372
Engineering, NEC[1]	28,324	32,319	31,692	36,885	41,514
Totals	208,416	237,252	259,013	277,886	333,393

Department of Agriculture
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	172	24	28	30	31
Chemical	38	96	107	116	119
Civil	-0-	51	46	50	51
Electrical	-0-	5	11	12	12
Engineering, NEC[1]	2,254	2,756	3,110	3,372	3,180
Totals	2,464	2,932	3,302	3,580	3,393

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR BASIC RESEARCH
By Selected Agencies and Engineering Disciplines

Department of Defense
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	10,833	13,785	14,278	14,297	16,511
Aeronautical	10,467	10,673	13,278	13,524	16,663
Astronautical	-0-	-0-	2,099	5,925	8,559
Chemical	3,393	2,424	1,469	1,564	1,632
Civil	72	751	966	1,196	1,755
Electrical	26,021	28,399	34,740	31,066	40,674
Metallurgy & Materials	19,751	25,205	30,528	32,749	39,906
Engineering, NEC[1]	13	4	60	314	-0-
Totals	70,550	81,241	97,418	100,635	125,700

Department of Energy
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	887	1,820	2,291	2,466	3,131
Chemical	211	1,173	-0-	-0-	-0-
Metallurgy & Materials	9,642	11,430	11,900	13,842	14,130
Engineering, NEC[1]	2,347	2,081	1,582	3,489	6,278
Totals	13,087	16,504	15,773	19,797	23,539

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR BASIC RESEARCH
By Selected Agencies and Engineering Disciplines

National Aeronautics & Space Administration
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	1,448	1,794	2,496	2,550	2,550
Aeronautical	10,558	11,923	11,638	11,900	11,900
Astronautical	995	824	1,264	1,300	1,300
Chemical	173	253	348	350	350
Civil	55	112	320	300	300
Electrical	1,900	2,281	2,466	2,500	2,500
Metallurgy & Materials	5,080	5,255	5,853	5,900	5,900
Engineering, NEC[1]	1,864	1,913	2,283	2,300	2,300
Totals	22,073	24,355	26,668	27,100	27,100

National Science Foundation
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	12,319	11,216	13,013	14,488	17,948
Aeronautical	1,046	-0-	287	323	391
Astronautical	-0-	121	169	180	220
Chemical	13,131	15,861	14,878	16,552	20,740
Civil	14,941	16,527	17,634	19,714	24,563
Electrical	19,561	22,237	23,847	26,278	32,607
Metallurgy & Materials	17,398	20,693	21,367	21,829	27,436
Engineering, NEC[1]	3,423	5,403	6,760	7,468	8,998
Totals	81,819	92,058	97,955	106,832	132,903

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR APPLIED RESEARCH
By Selected Agencies and Engineering Disciplines

Total, All Agencies
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	7,296	7,692	8,380	9,074	8,605
Aeronautical	15,687	16,681	13,292	13,594	14,062
Astronautical	6,322	7,807	6,050	8,444	6,173
Chemical	3,304	2,089	2,617	2,915	3,011
Civil	6,556	7,469	8,172	7,173	6,808
Electrical	29,784	33,165	27,547	28,741	32,582
Metallurgy & Materials	5,456	6,922	5,694	6,276	7,200
Engineering, NEC[1]	40,902	46,269	30,743	35,165	34,887
Totals	115,307	128,094	102,495	111,382	113,328

Department of Agriculture
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	55	63	56	61	63
Chemical	14	145	130	142	146
Civil	-0-	133	108	117	120
Electrical	-0-	16	14	15	15
Engineering, NEC[1]	4,845	5,105	5,452	5,910	5,588
Totals	4,914	5,462	5,760	6,245	5,932

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR APPLIED RESEARCH
By Selected Agencies and Engineering Disciplines

Department of Defense
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	4,201	3,691	4,421	5,039	4,603
Aeronautical	13,058	13,754	9,499	9,568	10,037
Astronautical	6,082	6,702	5,409	7,351	5,077
Chemical	428	764	465	479	535
Civil	1,266	2,164	1,783	2,191	2,115
Electrical	25,422	27,029	20,693	21,942	25,913
Metallurgy & Materials	2,417	3,995	3,508	3,814	4,697
Engineering, NEC[1]	613	1,969	3,135	3,058	4,922
Totals	53,487	60,068	48,913	53,442	57,899

Department of Energy
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	1,199	1,017	23	20	10
Astronautical	-0-	792	234	668	671
Chemical	2,559	331	173	476	478
Civil	43	529	1,548	681	370
Electrical	1,744	2,578	1,559	1,476	1,333
Metallurgy & Materials	-0-	1,650	10	40	27
Engineering, NEC[1]	22,797	23,580	8,563	11,562	9,617
Totals	28,342	30,477	12,110	14,923	12,506

1: Not Elsewhere Classified
2: Estimates

FEDERAL FUNDING OBLIGATIONS TO UNIVERSITIES AND COLLEGES FOR APPLIED RESEARCH
By Selected Agencies and Engineering Disciplines

National Aeronautics & Space Administration
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	1,614	2,240	2,687	2,850	2,850
Aeronautical	2,629	2,927	3,781	4,025	4,025
Astronautical	240	298	406	425	425
Chemical	33	12	45	50	50
Electrical	2,203	1,975	1,960	2,100	2,100
Metallurgy & Materials	481	468	467	500	500
Engineering, NEC[1]	2,239	2,325	2,500	2,650	2,650
Totals	9,439	10,245	11,846	12,600	12,600

National Science Foundation
(Thousands of Dollars)

	1980	1981	1982	1983[2]	1984[2]
Mechanical	227	681	1,193	1,104	1,079
Aeronautical	-0-	-0-	12	1	-0-
Astronautical	-0-	15	1	-0-	-0-
Chemical	270	837	1,804	1,768	1,802
Civil	5,247	4,643	4,733	4,184	4,203
Electrical	415	1,298	3,321	3,208	3,221
Metallurgy & Materials	2,558	809	1,709	1,922	1,976
Engineering, NEC[1]	755	493	662	552	558
Totals	9,472	8,776	13,435	12,739	12,839

1: Not Elsewhere Classified
2: Estimates
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